Research Article

Comparison of Anterior and Posterior Kaltenborn Grade III Glide on Glenohumeral Joint for Improving External Rotation in Adhesive Capsulitis (Frozen Shoulder)

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Abstract

Background: Adhesive capsulitis is a common disabling and painful condition that causes limitation of both passive and active ranges of shoulder joint. Division of frozen shoulder can be into primary and secondary categories. Different techniques have been devised in physiotherapy to regain limited range of motion in adhesive capsulitis.

Objectives: To compare the effects of anterior and posterior grade III Kaltenborn glides on glenohumeral joint for improving external rotation and functional ability in patients with adhesive capsulitis.

Material and methods: This randomized controlled trial was conducted in University of Health Sciences, Lahore and 40 patients were recruited from Mayo Hospital, Lahore from 08-10-2019 to 10-02-2020 and divided randomly into two groups. Group A was given anterior glide and Group B was given posterior glide. Treatment was given for 4 weeks, 3 sessions in each week. Outcomes were measured in terms of external rotation and functional status of shoulder from Goniometry and SPADI scale.

Results: Comparison of External rotation and SPADI score of group A (Anterior glider) and group B (posterior glide) has shown that both groups were similar at baseline ($p>0.05$ for all variables) but post-treatment mean external rotation range in group A was 36.50 ± 7.72 while in group B was 52.80 ± 7.14, with the P value <0.05 and post-treatment mean SPADI score in group A was 48.99 ± 3.68 while in group B was 38.30 ± 5.53, with the P value <0.05.

Conclusion: Posterior glide mobilization on glenohumeral joint is more significant in improving external rotation in patients with adhesive capsulitis as compared to anterior mobilization.

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Key words: Frozen Shoulder, Manual Therapy, Physical Therapy techniques, Kaltenbon, Joint mobility

Introduction:

Frozen shoulder or adhesive capsulitis is a common disabling and painful condition that causes limitation of both passive and active ranges of shoulder joint by formation of excessive adhesions across the shoulder joint[1]. Codman described this condition using the term frozen shoulder and later on the term adhesive capsulitis was coined by Neviaser. Its pathophysiology is not well understood and sometimes the etiology of the condition is not known[2].

It is seen that the general population that is affected by frozen shoulder is about 2-5% with females affected more than males[3]. Some musculoskeletal conditions are found to be common in diabetic patients and adhesive capsulitis is one of these conditions[4]. The age range that is found to be most commonly involved is between 40-65 years. But in patients with diabetes it appears at an earlier age[3]. Occurrence of this disorder in one of shoulder increases the risk of involvement of other shoulder[5].

The classification of frozen shoulder is confusing in literature. However it is divided into primary (idio-

pathic) frozen shoulder and secondary frozen shoulder which has some underlying etiology[5]. Systemic secondary frozen shoulder is most commonly found in patients with diabetes, may be due to the connective tissue disease process that is found as underlying cause of these systemic diseases[6,7].

For the diagnostic criteria of frozen shoulder, Cyriax described the capsular patterns according to which restriction occur in particular pattern, with greater restriction in the passive lateral rotation, some restriction in passive scapula-humeral abduction, and the slightest limitation in passive medial rotation. Along with decrease joint play, patients usually prsents with significant weakness in internal rotators, external rotators and abductors when compared to unaffected side[1]. Apart from the physical examination Radiography also provides useful information in diagnosis of frozen shoulder as it rules out other pathological conditions of the osseous structures[8].

Although it is considered that adhesive capsulitis is self-limiting process of 12-18 months but symptoms may persist that can be best treated with different physical therapy treatment options. Although there is no agreed consensus on treatment techniques of frozen shoulder, a variety of treatment options are recommended, these include joint mobilization, joint manipulation, corticosteroid injections, physical therapy exercises, use of different modalities, manipulation done under anesthesia, arthroscopic or open release of contracture[9].

Yet no single treatment option is considered valid because of different treatment protocols, inclusion criteria and numerous outcome assessments which make comparison difficult. Moreover exercise determinants like frequency, the timings of visits, and the discharge criteria have not yet been established and there is a need of further research for the optimum use of common physical therapy treatments like exercises and joint mobilization[10].

Traditionally, anterior glide is used on humeral head to improve external range of motion as a treatment of choice based on convex on concave concept. There is limited literature on comparing the effects of anterior versus posterior directed glenohumeral joint mobilization to improve external rotation. The rationale behind doing this is to determine the direction of movement for glenohumeral joint mobilization that may result in greater improvement in external rotation. The outcomes of this study could potentially guide clinical decision making.

The objective of this study is to compare the effects of anterior and posterior grade III Kaltenborn glides on glenohumeral joint for improving external rotation and functional status in patients with adhesive capsulitis.

Methods:

It was a single blinded Randomized controlled trial, conducted at Mayo Hospital, Lahore from 08-10-2019 to 10-02-2020. Approval of the study was obtained from Ethical Review Committee of University of Health Sciences, Lahore and IRB Ref. number is UHS/t. DPT/334. Furthermore, ethical concerns approval was also taken from Mayo hospital's respective authorities. Informed consent was taken from the willing patients before participation in the study. 40 patients both male and female were included in study according to inclusion criteria of ages between 30 to 60 years, having limitation in external rotation of unilateral glenohumeral joint and with normal radiographic findings. Participants were excluded if having history of any intrinsic pathology of glenohumeral joint, such as arthritis or rotator cuff tear, shoulder surgery, subsequent fracture in the same area of shoulder, frozen shoulder associated with other conditions like stroke, patients of Parkinson disease were excluded from the study. Participants were divided into two groups by computerized generated randomization table and the sample size was calculated, keeping the Power equal to 90%, the level of significance was equal to 95% and the confidence interval 95.

$$n = \frac{\left\{ z_{1-\alpha/2}\sqrt{2\bar{P}(1-\bar{P})} + z_{1-\beta}\sqrt{P_1(1-P_1)+P_2(1-P_2)} \right\}^2}{\left(P_1 - P_2\right)^2}$$

Anticipated proportion of population in Group A was 0.03[11] while anticipated population proportion in Group B was 0.31 = [(11)] and calculated sample size was 36 but 40 patients were included to avoid loss of follow up during treatment.

For the diagnosis of frozen shoulder physical examination along with muscle MMT was performed and shoulder radiographs were observed to rule out any

other pathology.

As an outcome tool to measure external rotation (ER) range of motion at shoulder joint, goniometer was used. Position to measure ER was same for all the subjects. As a baseline measure ER was measured in each patient at predetermined 30-degrees abduction range of motion. And at each subsequent session shoulder was placed at the same predetermined abduction angle before measuring improvement in external rotation. Pain intensity and disability was measured by using shoulder pain and disability index (SPADI) as an outcome tool.

As a baseline treatment, hot packs were applied for 15 minutes to both groups before starting of treatment along with stretching and shoulder isometric exercises. In stretching exercises, pendulum exercises were performed in flexion, abduction and circular motion. In isometric exercises scapular retractions, shoulder flexion, extension, external and internal rotations were performed with manual resistance. Each exercise was performed for ten repetitions with five seconds hold[10].

In Group A patients were given Kaltenborn grade III sustained anterior glides to gain external range of motion in supine lying position and progressive glide in prone lying position. Sustained stretch was held for 1 minute and total of 15 minutes session was applied to patients.

In Group B Kaltenborn grade III sustained posterior glides were given to gain external range of motion in supine lying position for both initial and progressive glides. Sustained stretch was held for 1 minute and total 15 minutes session was applied to patients.

All the assessment, diagnosis and treatment were provided by physical therapist. No home exercise plan was given to both groups. Treatment was given for 12 sessions, 3 times a week for 4 weeks.

For statistical analysis, Statistical Package for Social Science (SPSS) version 23 was used. Shapiro Wilk test of Normality was used to assess the normality of data. Paired-t test was applied to measure the pre and post treatment difference of quantitative variable within groups. Independent t-test was applied to measure the baseline and post treatment difference between groups A and B with level of significance alpha was kept at 0.05.

Results:

Forty patients were included in the study and demographic data shows that mean age in Group A was 44.40±7.84 and in Group B was 44.20±7.61. There were 55% (n=11) of females and 45% (n=9) were males in group A and 65% of females and 35% were males in group B. Shapiro Wilk test of normality showed that data was normally distribute ($p > 0.05$ for each variable). Comparison of external rotation ROM of gleno-humeral joint and SPADI score at baseline shows that

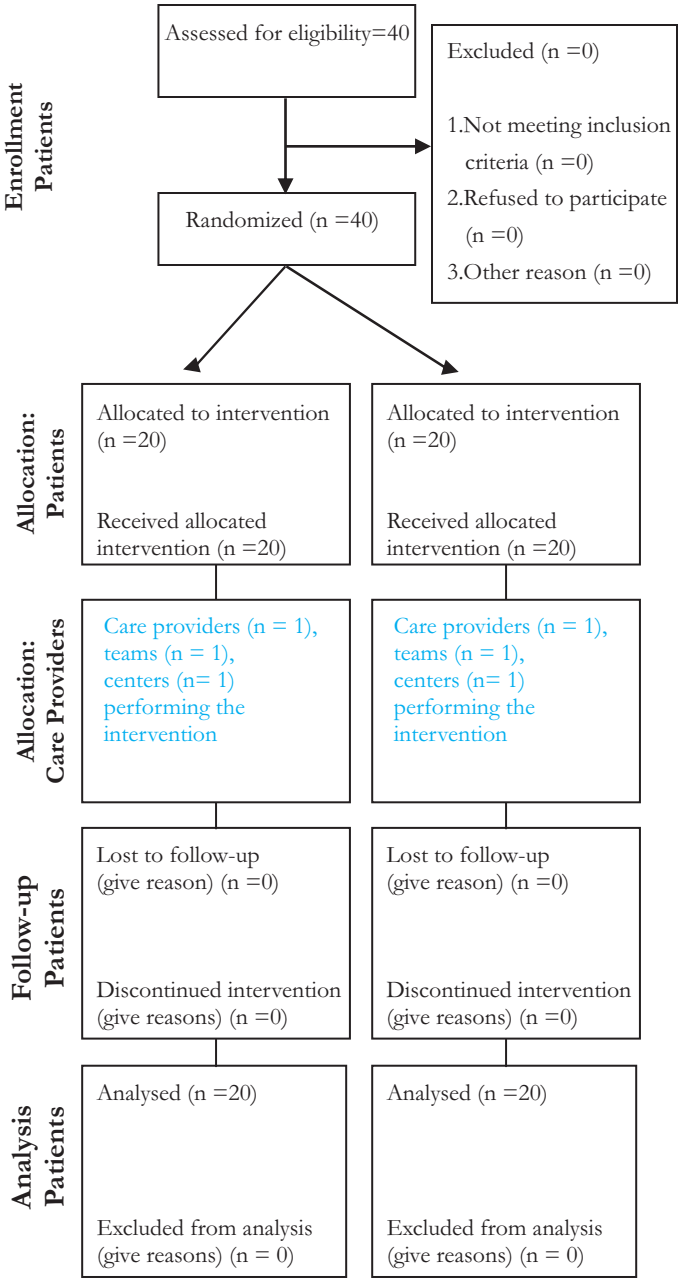

Fig. 1: *Modified CONSORT flow diagram for Non Pharmacological randomized controlled trials*

Table I: *Pre and Post Treatment comparison of ROM and SPADI score in Group A*

Variables	Group A (Baseline) n=20 Mean ±S.D	Group A (Post treatment) n=20 Mean ±S.D	p- Value
External Rotation of Glenohumeral joint (In degree)	20.55 ± 5.52	36.50 ±7.72	0.00
SPADI pain score (total score= 50)	38.40 ± 4.40	23.25 ± 4.68	0.00
SPADI disability score (total score= 80)	69.05 ± 5.28	40.55 ± 4.52	0.00
Total SPADI score (%) (cumulative pain & disability SPADI score/130*100)	82.61 ± 4.80	48.99 ± 3.68	0.00

Table II: *Pre and Post Treatment comparison of ROM and SPADI score in Group B*

Variables	Group B (Baseline) n=20 Mean±S.D	Group B (Post treatment) n=20 Mean±S.D	p- Value
External Rotation of Glenohumeral joint (In degree)	22.85 ± 5.74	52.80 ± 7.14	0.00
SPADI pain score (total score= 50)	39.55 ± 4.83	18.60 ± 5.03	0.00
SPADI disability score (total score= 80)	69.45± 4.39	31.20± 5.13	0.00
Total SPADI score (%) (cumulative pain & disability SPADI score/130*100)	83.80 ± 5.52	38.30 ± 5.53	0.00

Table III: *Comparison of ROM and SPADI score between Group A and Group B*

Variables	GROUP	Mean ±S.D	Mean difference	P value
Pretreatment SPADI pain score Total score=50	Group A	38.4000 ± 4.40574	1.15000	.437
	Group B	39.5500 ± 4.83926		
Post treatment SPADI pain score Total score=50	Group A	23.2500 ± 4.68901	4.65000	.004
	Group B	18.6000 ± 5.03043		
Pretreatment SPADI disability score Total score=80	Group A	69.0500 ± 3.28433	.40500	.743
	Group B	69.4550 ± 4.39299		
Post treatment SPADI disability score Total score=80	Group A	40.5500 ± 4.52449	9.35000	.000
	Group B	31.2000 ± 5.13604		
Pretreatment SPADI score Cumulative pain & disability SPADI score /130*100)	Group A	82.6105 ± 4.80885	1.23000	.457
	Group B	83.8405 ± 5.52240		
Post treatment SPADI score Cumulative pain & disability SPADI score /130*100)	Group A	48.9950 ± 3.68530		.000
	Group B	38.3030 ± 5.53962		
Pretreatment Shoulder External Rotation	Group A	20.5500 ± 5.52959	2.30000	.205
	Group B	22.8500 ± 5.74250		
Post treatment Shoulder External Rotation	Group A	36.5000 ± 7.72896	16.30000	.000
	Group B	52.8000 ± 7.14217		

both groups were similar, mean range of shoulder external rotation in group A was 20.55 ± 5.52 and in group B was 22.85 ± 5.74 (p value=0.205) (Table-I), while mean SPADI score (cumulative pain & disability SPADI score/ 130*100) in group A was 82.61 ± 4.80 and in group B was 83.80 ± 5.52 (p value=0.457) (Table-II). All subjects had marked painful restriction of active and passive shoulder ROM particularly external rotation with decreased functional ability of shoulder.

Comparison of Pre and Post treatment external rotation and SPADI has showed that there were significant improvement (p value=0.00) in ROM and functional status in both groups as presented in (Table I and II).

Comparison of External rotation and SPADI score of group A (Anterior glider) and group B (posterior glide) has shown that both groups were similar at baseline (p>0.05 for all variables) but there were significant difference between post treatment external rotation ROM and SPADI scores as presented in Table III , post-treatment mean external rotation range of motion in group A were 36.50 ± 7.72 while in group B were 52.80 ± 7.14, with the P value of 0.00 and post-treatment mean SPADI score in group A were 48.99 ± 3.68 while in group B were 38.30 ± 5.53, with the P value of 0.00, showing that posterior glides were more significant in improving external rotation and functional status of patient with adhesive capsulitis.

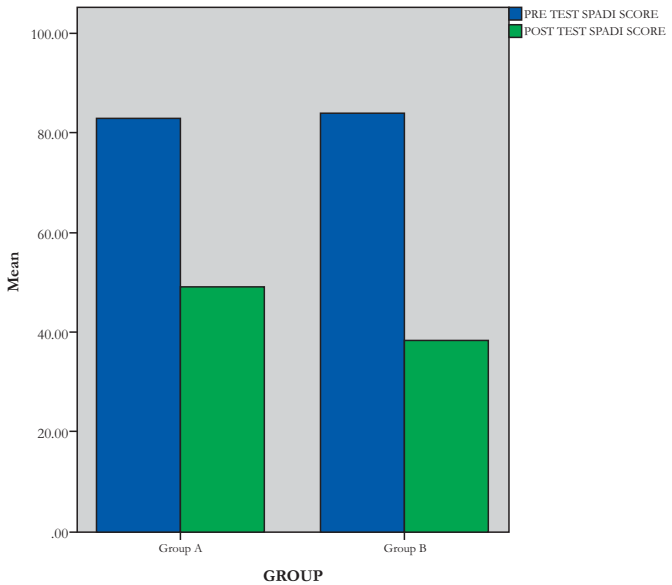

Fig. 2: *Comparison of Pre and Post treatment SPADI score in Group A and Group B*

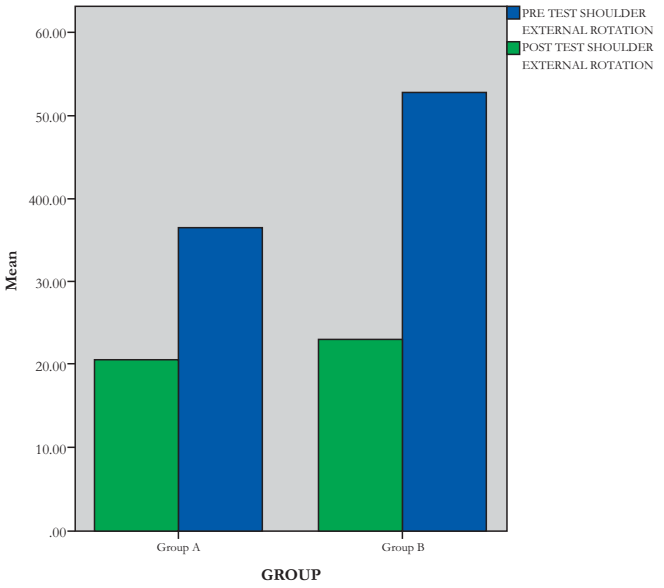

Fig. 3: *Comparison of Pre and Post treatment Shoulder External Rotation ROM in Group A and Group B*

Discussion:

The results of this study indicate that both of groups showed improvement in range of motions and improvement in functional status. However only group with posterior glide showed more improve-ment in external rotation range, reduction in pain intensity and improvement in functional status with p-value < .05.

Joint mobilization has hypoalgesic effect[12]. Lessening of pain can be described on the basis of neurophysiological phenomenon which is connected with movement of the joint. The type I and type II mechanoreceptors are reflexogenically stimulated while type IV nociceptors are inhibited which reduces the tone of guarding muscles, peri-articular tissues and appreciation of pain[13]. The Results of this study is consistent with present study as pre and post treatment comparison of Pain subscale of SPADI with in groups has showed that pain was effectively reduce in both groups (p=0.00) while between group comparison has showed that posterior glide (group B) was more effective in reducing pain (p=0.004)

Traditionally in clinical practice following the concave convex rule usually translating the humeral head anteriorly is used to gain external range of motion. Conversely there are studies showing that posterior gliding is more effective than anterior translation for recovery of external range of motion in shoulder joint[13], this corea-

ltes with Roubal et al in order to improve shoulder rotation applied posterior translation of humeral head[14]. In a study conducted by Wen Zhao et al it was proposed on that humeral head translation was affected by tight rotator cuff muscles and contractures of shoulder joint. This tightness causes anterosuperior translation of the humeral head restricting the posterior gliding during external rotation[15]. The Results of this present study are consistent with these previous evidences.

Results of this study show that capsule of the joint have an important role in translating the humeral head. For normal shoulder joint to function properly and its stability coordination of all the active and passive stabilizers is necessary. If pathological changes occur in any of these structures that can lead to abnormal translation of the humeral head in relation to glenoid fossa[11].

Kaltenborn grade III mobilizations were given at or near the end range that has more noticeable effect on the joint mobility and improving joint arthrokinematics[16].

From the inferences of this study it is suggested that posterior mobilization for gaining external rotation, reducing pain and improving functional status should be considered as comparison of total SPADI score of group A and group B has shown that there were significant difference between post treatment SPADI scores, post-treatment mean SPADI score in group A were 48.99 ± 3.68 while in group B were 38.30 ± 5.53, with the P value of 0.00, showing that posterior glides were more significant in improving external rotation and functional status of patient with adhesive capsulitis.

Both groups in this study were given shoulder strengthening exercises that included strengthening of rotator cuff and large muscle groups around shoulder joint. Improvement in range of motion and pain might be due to increase in strength of these muscles which is supported from previous literature[10].

In this study dominancy of hand factor was not considered which could influence the outcome as non-dominant side might be expected to heal quickly after treatment because it has to bear less daily repetitive stresses as compared to dominant side. This study permitted all the movements of daily activities so diverse motions of each patient could not be controlled.

Duration of the symptoms was also not pointed as it is speculated that patients with chronic involvement might not respond well as compared to acute condition. Sample size was small so the results cannot be generalized to wider array of population.

Further studies are required to explore the definite treatment methods to improve range of motion of shoulder joint with adequate number of patients included, to comprehensively evaluate each component of the treatment regime and assessing the effects of outcomes on functional abilities of patients. Studies of these sorts will help in refining the outcomes of treatments and in defining indications of what mobilization methods to be used to gain range of motion.

Conclusion:

Posterior glide mobilization on glenohumeral joint is more significant in improving external rotation in patients with adhesive capsulitis as compared to anterior mobilization.

Ethical Approval: Given

Conflict of Interest: The authors declare no conflict of interest.

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